

Text comprehension in solving additive word problems

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Problem addressed

In general problem solving, and particularly in solving word problems, students display various difficulties, some of which are associated with text comprehension (Verzosa & Mulligan, 2013). We examine the mathematization cycle, elements of reading, text comprehension, and the characteristics of problems and their influence on the solving process.

In our literature review, we identified studies that used quantitative methods to investigate correlations between problem-solving ability and text comprehension (Can, 2020; Vilenius-Tuohimaa et al., 2008; Walkington et al., 2018). A lack of studies was found that considered how students read and their text comprehension process.

What Is researched and how?

To analyze reading processes, we assessed the literacy level proposed by Ferreiro and Teberosky (1979) as a selection criterion for the study participants, since the alphabetic level allowed students to work on activities independently. However, since the reading process involves more than just decoding written symbols (Fernández de Castro & Ramírez-Ramírez, 2021)

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achieving reading comprehension requires students to make interpretations and inferences that allow them to give meaning to the text. Specifically, when solving word problems, reading has a more complex function: to interpret linguistic and mathematical symbols and initiate a problem-solving process (Cummins et al., 1988).

We analyzed the mathematization process of additive word problems by elementary school students. Mathematization (Jupri & Drijvers, 2016) entails reading processes and text comprehension, which are essential to transform the problem from natural language to mathematical language for solving the problem. To assess their text comprehension, we employed the Cloze test to determine the level of linguistic-syntactic and mathematical-semantic concordance (Arellano García et al., 2021) by the mathematical model proposed by students to solve the problem, as well as their approach to mathematization both horizontally and vertically.

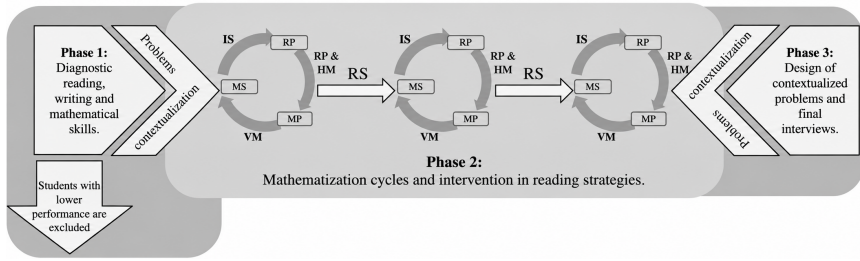
We designed a teaching experiment (Lamb & Geiger, 2012) to test how students read, comprehend, and solve additive word problems. The implementation was carried out in three phases over eight workshop sessions (Figure 1):

Phase 1. Diagnosis. We classified the participant students using a dictation, reading, and written mathematical test to score their alphabetic level and basic mathematical knowledge.

Phase 2. Mathematization cycles. Six additive word problems were designed. The underlying mathematical structure of the problems corresponds to the classification proposed by Carpenter and Moser (1982): joining, separating, part-part-whole, comparison, equalizing-add on, and equalizing-take away. Two interventions in reading strategies were conducted using two texts, and comprehension questions (Solé, 1998), to be answered before, during, and after reading.

Phase 3. Problem design. Students designed their own contextualized problems and shared their experiences in final interviews about problem-solving and the text comprehension process.

Figure 1
Teaching experiment phases



The data analysis we conducted is based on a structure of analytical categories that assess the linguistic-syntactic and mathematical-semantic aspects of the mathematization process followed by students (Table 1).

Table 1
Categories and indicators for the analysis of additive word problems

Horizontal mathematization (I)		Vertical mathematization	Horizontal mathematization (II)
Linguistic-syntactic analysis		Mathematical-semantic analysis	
Text comprehension	Mathematical model	Mathematical solution	Interpreting solution
- Semantic concordance - Syntactic concordance	- Identify sets - Accurate structure	- Right solution	- Contextualized solution

These analysis tools allowed us to identify different levels of achievement in the students’ performance through vertical and horizontal mathematization processes, such as reading and text comprehension by semantic and syntactic concordance in Cloze test, the accuracy of the mathematical model proposed to solve the problem and the interpretation of the solution in the problem context.

Implications and significance

Analysis tools for exploring students’ mathematization cycles and text comprehension process allow us to understand how they read, interpret, and model a solution for the problem. We observed that although students demonstrated partial semantic concordance with the words to complete the texts and global comprehension of problems, this was insufficient for solving the problems accurately. We concluded that an adequate reading process is a necessary but not sufficient condition for successful problem solving.

This study proposes a methodology for implementing strategies to connect contextualized additive word problem resolution with text comprehension and being applied at the educational system level due to the New Mexican School, which demands considering students’ school and social environment to develop significant and useful knowledge. It could be implemented by teachers according to the students’ ability, their social context and the mathematical structure.

References

- Arellano García, Y., Hernández Cruz, L., & Hernández Moreno, A. (2021). Complejidad lingüística y semántica en el planteamiento de problemas por estudiantes, profesores en formación y profesores en servicio de bachillerato [Linguistic and semantic complexity in problem posing by students, pre-service and service teachers in high school]. *IE Revista de Investigación Educativa de la REDIECH*, 12, e1201. https://doi.org/10.33010/ie_rie_rediech.v12i0.1201
- Can, D. (2020). The mediator effect of reading comprehension in the relationship between logical reasoning and word problem solving. *Participatory Educational Research*, 7(3), 230–246. <https://doi.org/10.17275/per.20.44.7.3>
- Carpenter, T. P., & Moser, J. M. (1982). The development of addition and subtraction problem-solving skills. In T. P. Carpenter, J. M. Moser, & T. A. Romberg (Eds.), *Addition and subtraction: A cognitive perspective* (pp. 9–24). Routledge. <https://doi.org/10.4324/9781003046585>
- Cummins, D. D., Kintsch, W., Reusser, K., & Weimer, R. (1988). The role of understanding in solving word problems. *Cognitive Psychology*, 20(4), 405–438. [https://doi.org/10.1016/0010-0285\(88\)90011-4](https://doi.org/10.1016/0010-0285(88)90011-4)
- Fernández de Castro, J., & Ramírez-Ramírez, L. N. (2021). Comprensión lectora: Estudio cualitativo desde la voz de docentes de educación básica en México [Reading comprehension: A qualitative study from the voice of basic education teachers in Mexico]. *Revista Electrónica: Entrevista Académica, Especial*(3). <https://www.eumed.net/es/revistas/revista-electronica-entrevista-academica/mayo21/compression-lectora-mexico>
- Ferreiro, E., & Teberosky, A. (1979). *Los sistemas de escritura en el desarrollo del niño* [Literacy before schooling]. Siglo XXI Editores.
- Jupri, A., & Drijvers, P. (2016). Student difficulties in mathematizing word problems in algebra. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(9), 2481–2502. <https://doi.org/10.12973/eurasia.2016.1299a>
- Lamb, J., & Geiger, V. (2012). Teaching experiments and professional learning. In N. M. Seel (Ed.), *Encyclopedia of the sciences of learning*. Springer. https://doi.org/10.1007/978-1-4419-1428-6_1017
- Solé, I. (1998). *Estrategias de lectura* [Reading strategies]. Graó.
- Verzosa, D. B., & Mulligan, J. (2013). Learning to solve addition and subtraction word problems in English as an imported language. *Educational Studies in Mathematics*, 82(2), 223–244. <https://doi.org/10.1007/s10649-012-9420-z>
- Vilenius-Tuohimaa, P. M., Aunola, K., & Nurmi, J.-E. (2008). The association between mathematical word problems and reading comprehension. *Educational Psychology*, 28(4), 409–426. <https://doi.org/10.1080/01443410701708228>

- Walkington, C., Clinton, V., & Shivraj, P. (2018). How readability factors are differentially associated with performance for students of different backgrounds when solving mathematics word problems. *American Educational Research Journal*, 55(2), 362–414. <https://doi.org/10.3102/0002831217737028>

