Are Word Problems Overrated? Or Are We Just Using Them Wrong?

Are Word Problems Overrated?

Word problems, sometimes referred to as situational problems, or authentic Math problems are often placed on a pedestal within the Math Ed universe, especially with constructivist authors and influencers. The argument is typically that we want students to be able to apply their Math skills to real life problems and not just abstract questions on a page. To some extent the constructivists are obviously right. Outside of education, we rarely have to solve Math questions neatly written in abstract form on a page. Students therefore do need to learn how to apply their Math knowledge to real life situations and word problems are the obvious way to teach this. And yet, I think the constructivists and the overall Math community are still missing something here.

Being able to solve a complex word problem requires a synthesis of skills. Similar to reading comprehension there is no singular application skill for Math. Having students endlessly work on word problems is not the most efficient way to improve students' application ability, just the same as having students practice reading without teaching them phonics is not the most efficient way to improve reading comprehension.

Students need to develop their knowledge of math facts, basic algorithms, and conceptual knowledge to solve word problems. And the best way to teach Math fluency of Math facts and algorithms is with abstract Math problems. It really comes down to time efficiency. Students can practice hundreds of Math facts in minutes. But complex word problems? Just a handful can take a very long time. Abstract problems like 3+6, are much more time efficient, this allows more repetitions in less time and leads to better Math outcomes. Working memory is limited. When students no longer have to devote attention to basic calculations, they can instead devote more cognitive resources to understanding the structure of the problem. Building fluency therefore supports—not replaces—students' ability to solve complex word problems. (Gersten, et al, 2009; Baker, et al, 2002; Stockard, et al, 2018; Cason, et al, 2019).

While application knowledge is not a singular skill, it would be an over simplification of the research to suggest that we cannot teach students how to solve word problems. Indeed, we have multiple meta-analyses showing that we can, including (Kong, et al, 2021 & Myers, et al, 2022). Both meta-analyses found effect sizes for over .80 for word problem instruction. It has therefore been empirically established that we can train students to be better at applying their Math knowledge to new and difficult problems.

So, When Should We Teach Word Problems?

In my opinion it makes the most sense to use less word problems, when students are in the acquisition (brand new) or fluency building (accurate but slow) stages. However, as students learn to use an algorithm with ease they need practice applying these algorithms to real life situations, so they can fully generalize their Math skills. It therefore makes sense to me that we use more word problems as students develop their Math skill and knowledge. In other words, the further into a lesson/unit, the more word problems we should use. And by this logic, the less Math knowledge a student has on a topic, the less word problems they should receive on that topic.

How Should We Teach Word Problems?

Okay, we have established that word problems are important and that we can teach students how to solve word problems, but that developing this skill should happen after students have already gained sufficient knowledge for math facts and algorithms. So how do we teach this application?

A couple of years ago I reviewed meta-analyses by (Kong, et al, 2021) and (Myers, et al, 2022) on this topic. Both meta-analyses found that strategy and schema instruction showed some of the strongest evidence for supporting students with word problems. I looked at this question again recently while researching for an upcoming book and found no better papers on the question. (Kong, et al, 2021) reviewed 19 studies on students with learning disabilities in grades K-6 and found an effect size of 1.17 for strategy instruction and 1.14 for schema instruction. (Myers, et al, 2022) looked at 9 studies for grades 4-9 and focused on students with mild learning difficulties. Their meta-analyses found a mean effect size of .88 for both schema and strategy instruction. When I interviewed Dr. Sarah Powell for my podcast on word problem instruction, she talked about the power of schema and strategy instruction. All of this is to say that, I have been generally aware of the fact that research shows strong positive outcomes for schema and strategy instruction in Math, for years.

However, until this last school year, I had never actually tried using either practice. Truthfully, I am a bit embarrassed to admit, but I was not even aware of how one went about implementing either approach. I found a phenomenal paper by Dr. Sarah Powell on the topic (2011) -listed in the references, be sure to check it out-. This paper helped me to better understand the difference between strategies and schema, their purpose in word problem instruction, and a handful of different models that can be used for both. I tried out several frameworks this year, and in this blog post I will share the ones I found most helpful/aligned with my teaching philosophy.

So What is Schema Instruction?

Schema instruction teaches students to identify the underlying mathematical structure of a word problem. Teaching these schemas helps students to see the patterns that exist in word problems and more quickly identify how to solve them. There are five main types of word problem schema often taught to students. By explicitly teaching these types of schema, we can help students more efficiently identify the underlying math operations and concepts in a word problem (Jitendra, 2007; Powell, 2011).

Table 1.
The 5 Schema Types

Schema Type	Description	Example Logic
Total	Combining separate parts to find a whole.	Part + Part = Whole
Difference	Comparing two sets to find the amount of difference.	Larger - Smaller = Difference
Change	An initial amount that increases or decreases over time.	Start +/- Change = End
Equal Groups	Multiple identical groups combined for a total product.	Groups x Number in Group = Product
Comparison	A set that is multiplied or scaled for a product.	Set x Multiplier = Product

Source: (Powell, 2011)

Personally, I taught schema in three steps.
Step 1. I had the students write a note in their Math notebooks (something we do on a regular basis) and as they wrote, I explained/introduced the concept.
Step 2. I gave the students very simple word problems that very clearly aligned with one of the 5 schemas and then asked the students to first identify the schema being used, then solve the question. We took up each question as a class, and repeated this process until I was sure that students had a firm grasp of the concept. (Step 2, took about 5 days).
Step 3. I gave the students more complicated word problems, often with multiple schemas and asked students to identify the schemas being used and to solve the questions.

I found the repetition of the schema instruction did help the students to build a sense of automaticity and fluency with word problems. It helped the students become better at solving word problems because they learn to recognize common structures, not because they have acquired a general problem-solving ability that transfers to every novel situation. This distinction helps explain why explicit schema instruction is so effective: it teaches students to identify recurring mathematical structures that appear across many different contexts. Okay so what about strategy instruction?

What Does Math Strategy Instruction Look Like?
Truthfully, math strategy instruction can be teaching students any strategy that helps them solve the equation. Technically, teaching students to visualize a problem or to draw diagrams are strategies. However, what I am really referring to is a defined process for students to solve a word problem. This helps prevent the moment that every teacher has experienced when teaching difficult word problems, where students simply freeze and say “I don’t know what to do”. I played with a few such processes this year. But I liked the RIDE strategy best,

simply for its simplicity. The approach does not over convolute the process and the acronym is easy to remember. I would like to take the credit for coming up with the idea, but I stole it from (Powell, 2011). With the RIDE approach, the acronym stands for:

Table 2
The RIDE Strategy

R	Read the problem
I	Identify the relevant information
D	Determine the operation and unit for the answer
E	Enter the correct numbers, calculate, and check the answer

I don't think this approach is magical. But, personally I found having students learn this process helped students to unfreeze, when they had that moment of apprehension, when facing a difficult problem. Moving forward, I will likely teach both the 5 schema and the RIDE strategy part way through every September and then reinforce as the year continues.

If you are looking for resources to support word-problem instruction, consider the following:

Resource	Description	Link
Pirate Math	A free word-problem program developed by Dr. Sarah Powell and Dr. Katherine A. Berry.	https://www.piratemathequationquest.com/about.html
SAGE Online Academy	A feemium self-marking online classroom platform (similar to Google Classroom, but with pre-built lessons and educational games that students can unlock through participation). The platform includes apps for procedural math instruction, math fluency, and word-problem instruction. Its word-problem app combines schema instruction, strategy instruction, and AI-supported guidance to help students solve word problems. The AI model is specifically designed to reinforce schema- and strategy-based instruction. The core math applications are completely free.	https://www.sageonlineacademy.ca/landing

Solving Word Problems Using Schema	A free, in-depth article by Dr. Sarah Powell explaining how to use schema and strategy instruction to teach word-problem solving.	https://doi.org/10.1111/j.1540-5826.2011.00329.x

Final Thoughts

Word problems deserve an important place in mathematics instruction, but they should not replace other pillars. Students first need sufficient mathematical knowledge and fluency before application tasks become truly productive. Once those foundations are in place, explicit schema and strategy instruction provide powerful tools for helping students transfer their knowledge to increasingly complex situations. Rather than choosing between procedural practice and authentic application, effective instruction deliberately sequences both.

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