

Going Beyond PEMDAS

Summary: The vast majority of teachers use the PEMDAS rule (parenthesis/exponents/multiplication/division/addition/subtraction) to teach order of operations to their students. In an article for *Teaching Children Mathematics*, a professor of mathematics education discusses ways to go beyond PEMDAS to help students truly master the concept.

Practical Applications

The author explains that PEMDAS, while a useful memory device, can still lead to many misunderstandings because it is rule-based rather than helping students understand why the order of operations occurs the way it does. She gives several recommendations:

- Have students create narrative stories out of order of operation problems. For instance, ask them to describe a real-life situation that “could be represented by the expression $5 + 8 \times 6$.” Students might come up with stories about money, party planning or cooking, and their stories may reveal misunderstandings that are easy to correct. There are many opportunities for rich extension and discussion here: For instance, ask students how their story for that expression would differ from a story for the expression $(5 + 8) \times 6$.
- Use functions and patterns to have students derive the order of operations. For instance, an output pattern of 1, 3, 5, 7 could have a rule of $2 \times N - 3$, but that function will only give the correct outputs if the order of operations is followed properly.
- Have students do comparison activities, evaluating the same expression in different ways. For example, students could try doing the problem $3 \times 4 - 8 / 2$ on their own and then with a calculator, or they could try doing the problem by putting parenthesis in different places. The variety of answers provides the opportunity for strong discussions about the ‘why’ behind order of operations.
- If you do use PEMDAS, the author cites another researcher in suggesting that you list the letters in rows, to avoid the misunderstanding that multiplication comes before division or addition before subtraction. In rows, it would look like:
 - **P** parenthesis
 - **E** exponents
 - **MD** multiplication and division (left to right)
 - **AS** addition and subtraction (left to right)

Conclusion and Citation

Merely using PEMDAS as a rule without helping students understand the concept behind order of operations is an invitation to misunderstandings. Activities that give students deeper mastery of order of operations will help build their number sense now and in the future.

Jeon, K. “Reflecting on PEMDAS.” *Teaching Children Mathematics* (Feb. 2012), pp. 370-377. <http://bit.ly/ySrdpX> (subscription only).