COGNITIVE DEVELOPMENT NEWS

brought to you by the Cognition Learning And Development (**CLAD**) Lab at Notre Dame

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What's new in the CLAD Lab?

Helping families with learning during the pandemic

Happy holiday season from the CLAD Lab! This summer we had to say goodbye to our most senior grad student, Connor O'Rear. He successfully defended his dissertation, which focused on determining the features of counting books that promote book reading behaviors that help children learn counting concepts (*it's our featured CLAD Lab study*). Congrats, Dr. O'Rear! He is now a postdoc at Purdue.

This fall we've been busy working on a variety of projects. One of our most fulfilling projects has been helping to develop, direct, and staff two free structured remote learning programs in our community. One program is *TutorND*, a program initiated by the ND Provost's Office to meet an urgent need expressed by ND employees with children. The other program involves working virtually with children at one of our partner SBCSC elementary schools. Both programs enrich learners through evidence-based math and literacy lessons and activities that our lab has developed and/or vetted. Sessions are individually tailored to students' learning needs and interests. Families and schools have obviously been disrupted by the pandemic, and we feel blessed to have been able to help in this small way.

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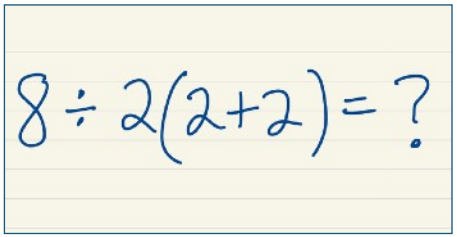
Spacing in Math Expressions



We know that subtle changes to the way we present math problems affects the way students solve those problems. Even a simple difference of presenting a problem with the blank at the end (e.g., 3 + 4 = __) versus at the beginning (e.g., __ = 3 + 4) matters. Researchers from Worcester Polytechnic Institute wondered if another subtle change to presentation might affect students' problem solving: the spacing! The researchers manipulated how numbers and operators were spaced in arithmetic expressions (e.g., 5+2*4). They asked 5th through 12th grade students to solve a series of these order of operation problems in one of four conditions: (1) a neutral, no space condition (e.g., 5+2*4); (2) a congruent condition, where the spacing reinforced the correct order of operations (e.g., 5 + 2*4); (3) an incongruent condition, where the spacing was inconsistent with the correct order of operations (e.g., 5+2 * 4); and (4) a mixed condition where students had ½ congruent and ½ incongruent problems. They found that students in the congruent and neutral conditions mastered the problems significantly faster than in the incongruent spacing condition. This finding is consistent with the idea that small differences in the perceptual features of problems, such as the spacing used, have the potential to influence students' problem solving.

Featured CLAD Lab Study: Counting Books and Number Talk

Counting books provide a source of early number talk for children. However, not all counting books are created equal. Connor O'Rear completed his dissertation looking at how different types of counting books might lead to different types of number talk. Research has shown that some of the most beneficial number talk for preschoolers is when a set of objects is both counted and labeled (e.g., 1-2-3-4! Four!). This "count-and-label" number talk helps children develop an understanding of the connection between counting and set size.

Connor was interested in how different features of counting books affect the amount of count-and-label number talk children hear. He looked at data from caregiver-child dyads who had come into the CLAD Lab to read counting books together. The dyads were randomly assigned to read different types of counting books that varied in terms of their features (e.g., tactile features, types of objects pictured, structure of the written text). Averaging across the different types of books, the dyads rarely produced the ideal count-and-label number talk. However, a book's features influenced how often count-and-label number talk occurred. Dyads were more likely to produce count-and-label number talk when counting books contained more representations of the set size (e.g., the numeral, the word written out, and the set to be counted), and they were less likely to produce count-and-label number talk when counting books had the number word at the very start or very end of the text on a page.

These findings can help improve the design of counting books. Well-designed counting books provide a tool for talking about mathematics with young children, so it's important to find the types of counting books that help children learn best. There is still more research to be done before we can design the ideal counting book that optimizes children's learning, but we can leave you with this evidence-based advice: when reading any counting book with children, it's helpful to both count the set and state how many items are in the set.

Does Learning from Screens Transfer to Physical Contexts?

As children spend more time with computers, tablets, and smartphones, it seems important to know what children actually learn from these devices. There are plenty of apps available to download, but does learning information from these apps actually transfer over into the physical world? Researchers from Swinburne University of Technology conducted a study to find out.

They first presented children ages 4-6 with a physical version of a mathematical puzzle called the Tower of Hanoi. Then, the children were split into two groups, with one group getting a chance to practice on the same physical version of the puzzle, and the other group getting to practice on a digital version of the puzzle on a touchscreen device. After practicing, children were asked to complete the physical puzzle again. Children in both groups improved when tested on the physical puzzle. Moreover, a follow up study found that children still performed well on the physical puzzle even if they only ever learned the puzzle digitally. This suggests that children can transfer what they learn from touchscreen devices to the physical world.

Additional evidence that learning from digital devices transfers to the physical world comes from a study by researchers at UT-Arlington. They examined the effects of handwriting practice on motor skills. Kindergarteners completed traditional, pen-on-paper handwriting exercises in the classroom, but half of the children were randomly assigned to replace 20% of their traditional exercises with exercises on the handwriting app "Letter School." Children in both conditions improved their writing of words, letters, and numbers similarly after 12 weeks of practice, but children who used the Letter School app actually improved *more* in manual dexterity than did those who only used pen and paper. Manual dexterity involves coordinated fine-motor skills like grasping and manipulating objects. It is a skill used for activities such as getting dressed and eating.

To conclude, what children learn on electronic devices can transfer to the physical world. This is great news for families with children who may be more interested in learning from touchscreen devices as compared to physical puzzles or traditional paper-and-pencil activities.

CLAD team updates

We are pleased to welcome new graduate student, **Trey Cobb**. He is a former middle school math teacher, and he comes to us from Chicago, IL. Welcome Trey!

In addition to **Connor O'Rear** (mentioned on cover), we also said goodbye to our seniors. **Alice Felker** is working at L'Arche Greater Washington, DC. **Allison VanOverberghe** is a graduate student at Teachers College, Columbia University. **Claire Rudden** is a first year ACE Teaching Fellow.

Patrick Kirkland, *grad student*, successfully defended his Master's Thesis, "Developing a Measure of Mature Number Sense with Valid and Reliable Scores."

Micaela Maron, **Olivia Jazbutis**, and **Chloe Spang**, *seniors*, will be working on their senior theses this academic year.

Joanna Azar, *lab manager*, continued to manage our team to wrap up our NSF-funded shared book reading studies. She navigated the shift to the virtual environment, so we could continue making excellent progress.

Prior to the pandemic, we were working in person with parent-child dyads in the lab for our shared book reading study. *Undergraduates* **Isabella Seip, Shannon Celeste** and **Amy Bahadursingh** and *staff research assistant* **Alyssa Dosmann** were critical to the success of these sessions.

It takes a herculean effort by the whole lab to transcribe and code hundreds of shared book reading sessions. Our team includes *undergraduates* **Alexandra Hicks, Jisel Gomez, Mitchell Kennedy, Madison Zajas, Muhammad Abubakar Mian, Ava Conklin, Ellyn Jarrell, Grace Fjerdal, Hannah Koch** and **Alexa Mogan** and *staff research assistants* **Will Huffman, Sara Norwood,** and **Julia Crant**.

Nicole McNeil, *lab director,* is co-PI on a new grant from the National Science Foundation (NSF)! The PI is Susan Goldin-Meadow from University of Chicago, and the other co-PIs are: Breckie Church, Fey Parrill, David Simkins, and Ryan Lepic. The project team will study how gesture can be used to augment web-based math instruction for children and adults.

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