A set of mathematical learning experiences designed for educators to explore the development of content understanding, verbal-language skills, and efficacy in early learners, ages 3 – 6.
Math is everywhere! Early learning experiences shape not only students’ mathematical thinking, but also their thinking about what mathematics is. Our goal is for young students to construct a deep understanding of mathematics. Students will be able to think and reason mathematically. They will talk about their mathematical reasoning and manipulate their world to make sense of the mathematics they encounter. *When students understand mathematics, they come to realize it is more than just simply knowing the correct answer.*

Students begin exploring mathematics in the world around them long before they begin school, and they continue to build on this foundation through early childhood education. Providing them with experiences to explore the math around them develops positive attitudes that form the foundation for future academic success. Through these initial formal experiences with mathematics, students begin to construct and solidify mathematical understanding. Because of this emerging understanding, the importance of mathematical exploration and discussion in early childhood cannot be overstated.
COVE is designed to support educators in assessing and advancing children’s thinking and reasoning in mathematics and was developed by IFL mathematics fellows based on years of research about teaching and learning in early childhood.

**Deepening Student Mathematical Understanding**

COVE helps educators deliver instruction that encourages engagement and sense-making. The activities in the kit take advantage of student curiosity and provide opportunities for students to explore mathematical concepts at their own pace. COVE sets clear expectations that students should communicate their thinking and reasoning about mathematical concepts through actions and expressive language.

**Encouraging Student Engagement and Sense-Making**

Teaching for engagement and sense-making entails being able to observe students and identify evidence that indicates understanding of a particular concept on a learning map. Teachers need a deep understanding of learning progressions to support students where they are in their learning of a concept with the goal of advancing them along the trajectory.

COVE concepts can be incorporated into existing curriculum, learning centers, and playtime.
The Design of COVE

COVE works to deepen educators’ understanding of content, pedagogy, and student thinking which can lead to more effective instruction.

The design takes into consideration the ways in which students engage with and make sense of mathematics (efficacy), and communicate their mathematical thinking (verbal language).

The Math of COVE

COVE consists of three concepts that are foundational for young children’s future mathematics learning:

- Sorting and Categorizing
- Conservation
- Counting and Cardinality
COVE toolkits contain materials for all three foundational early mathematics concepts: sorting and categorizing, conservation, and counting and cardinality.

For each concept there is a learning map, a set of mathematics instructional activities and manipulatives, and a collection of student videos.

**Learning Maps**
Each learning map is organized by key math ideas for the given concept and provides indicators for the key math ideas. The indicators are organized using the three lenses: content indicators, verbal-language indicators, and efficacy indicators.

*Can be used to*
  - deepen content knowledge;
  - plan questions that can be asked during a particular activity to target content knowledge, encourage the use of language, or support efficacy; and
  - identify where a student is on the learning map and consider the potential additional learning opportunities the student may need to advance their learning.

**Instructional Activities**
There are 6 activities per concept for a total of 18 activities. The activities are aligned and sequenced according to the learning map for the concept. Each activity includes suggested probing and follow-up questions that can be used to encourage students to share their thinking.

*Can be used to*
  - deepen content knowledge by studying the task sequences and identifying ways in which the tasks change;
  - check in with students in formative ways to gauge their understanding and language about a particular concept; and
  - develop additional activities to extend and expand student understanding.

**Collection of Student Videos**
The videos, organized by concept, show individual students and their teacher engaged in a COVE activity. A catalog of the videos is provided and contains a description of the student's engagement using the lenses of mathematical content, verbal-language, and efficacy.

*Can be used to*
  - deepen content knowledge about student thinking by studying student engagement and responses;
  - learn about and reflect on pedagogical practices by studying and analyzing the practices of another teacher;
  - hone observational skills by watching, documenting, and discussing evidence of student understanding.
COVE Learning Maps

The COVE learning maps are supported by current research on trajectories of learning. These progressions are significant as research has shown that children’s mathematical conceptual understanding and skill acquisition develop in a predictable order.

COVE learning maps illustrate student understanding of each concept through the lenses of math content, use of expressive language, and self-efficacy.

“Trajectories or progressions are ways of characterizing what happens in between any given set of beginning and endpoints and, in an educational context, describe what seems to be involved in helping students get to particular desired endpoints.”

COVE Activities and Lesson Guides

Each COVE activity has a lesson guide that provides essential information for supporting students as they engage. Lesson guides contain the mathematical and language focus for the activity. Possible student pathways and suggested probing and follow-up questions for eliciting and advancing student thinking are also provided.

COVE Videos and Video Catalog

Each video captures a student and their teacher engaged in a COVE activity. The videos are accessible via QR codes found in the video menu and in the video catalog for each concept. The video catalog contains a description of each video and a brief analysis of the student’s engagement.
Our Mission

The Institute for Learning (IFL) works to ensure that every student — especially those traditionally underserved due to income, race, and language — has access to high-level texts, tasks, and high-quality learning opportunities to build the critical thinking and deep reasoning skills that are required for success. We believe that the way to achieve equitable and sustainable change is to focus on coherent, evidence-based learning for all educators across an educational system.

About Us

The IFL is an outreach of the University of Pittsburgh’s Learning Research and Development Center (LRDC). Comprised of scholar practitioners called fellows, the IFL helps educators bring what research tells us about teaching and learning into classrooms to help students grow their intelligence and reach the high standards demanded by today’s colleges and workforce. We believe — and research confirms — that virtually every student is capable of high achievement, if they work hard at the right kinds of learning tasks.

To do this, the IFL

- serves as a professional development leader. We design instructional materials, tools, strategies, formative assessments, and other resources to enhance instructional effectiveness in K–12 classrooms.
- provides educational services. We offer customized preparation and consulting designed to meet districts where they are in the school reform process.
- operates as a think tank. We bring to educators the best current knowledge and research about learning processes and principles of instruction.
- offers research-based solutions to the challenges facing public education. Our work has been and continues to be evaluated by independent researchers and organizations, including the Institute of Education Sciences, RAND Corporation, and MDRC, among others.

The IFL functions as a bridge between the domains of research and practice, bringing educators the best of current knowledge, research, tools, and models related to instruction and district design.

Contact us today to learn how to become a partner.

ifl@pitt.edu | 412.624.7700 | ifl.pitt.edu