

# Developing Tools and Routines for Formative Assessment in Additive Reasoning



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Ongoing Assessment Project (OGAP)

@OGAP\_Philly @CPREresearch  
#OGAP #formativeassessment #math



## Objectives

This is an **early stage design and development project** focusing on developing and piloting **research-based formative assessment tools and routines** for the early elementary grades.

In collaboration with the **Ongoing Assessment Project (OGAP)** we are translating findings from research on student learning of number and operations into tools, resources and routines for teachers to regularly elicit and analyze students' understanding and develop targeted instructional responses.

The project includes multiple iterations of design, field-testing, data collection, and revision to improve the implementation of these resources in school settings.

## Timeline

**Year 1 (2016-17)** Materials development and piloting

**Year 2 (2017-18)** Large-scale field testing

- Teachers, math leaders, and trainers
- Data collection on implementation in Philadelphia
  - Interviews, observations, survey
  - Measure of teacher knowledge (TASK)

**Year 3 (2018-19)** Data analysis and refinement

**“The available learning trajectories should be translated into usable tools for teachers.”**

(Daro, Mosher, and Corcoran, 2011, p. 13)

## 2 Additive Reasoning Framework

Task Considerations

| Problem Contexts  | Problem Structures  | Learning Progressions  |
|---|---|--|
| Counting<br>Quantity<br>Patterns<br>Additive Situations<br>Add to<br>Take from<br>Put together/Take apart<br>Compare<br>Concepts/Properties<br>Properties and Relationships<br>Base 10<br>Place Value<br>Concepts<br>Strategies | Type of Items<br>Contextual<br>Non-contextual<br>Complexity of Addends<br>Single-digit<br>Multiple-digit<br>Multiples of 10, 100, 1000<br>Representations<br>Number Paths<br>Base 10<br>Base 10<br>Ten Frames<br>Dot Images | Meanings for Subtraction<br>Difference<br>Removal<br>Distance<br>Missing addend<br>Number of steps<br>Single step<br>Multi-step<br>Interpreting evidence and informing instruction |

Learning Progressions  
Interpreting evidence and informing instruction



Sorting Student Work  
By strategy levels

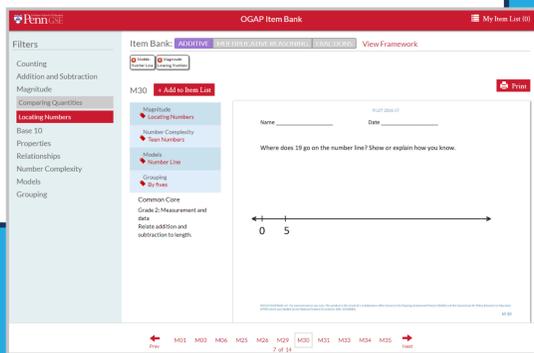


Instructional Guidance  
To support movement up the progression

Underlying Issues/Errors  
For attending to secondary information

## 1 Item Bank

- Online resource of 327 formative assessment items
- Piloted in over 30 grades K-3 classrooms
- Searchable by content, problem structure, magnitude of numbers, models, or size of groups



### Additive Level

Flexibility, efficiency, fluency

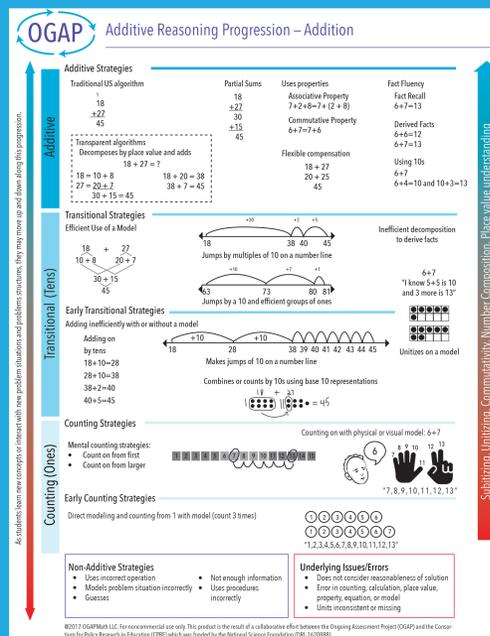
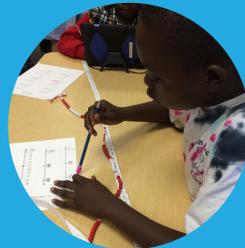
Built on conceptual understanding

### Transitional Level

Provides an instructional link between counting and additive strategies—important for **EQUITY AND ACCESS**

### Not strictly linear

Strategies move up and down the progression depending on problem context and difficulty



## 3 Professional Development

**3** 12 modular professional development sessions that comprise 4-5 full days focused on:

- Foundational concepts: Number Sense, Counting, Subitizing, Number Composition, Number Lines, Equality and Properties
- Operations and fluency: Addition, Subtraction, Basic Fact Fluency
- Supporting content and instructional strategies (CCSSM expectations for Addition and Subtraction, Problem Solving and Exploring the Item Bank).
- Sorting student work and case studies of OGAP implementation



## 4 Additional Resources

- Pre-assessments
- Evidence collection sheets
- Observation checklists for kindergarten
- Counting Collections resources
- Developing Fluency with Number Lines guide
- "Teacher Tips" biweekly emails



## What are We Learning?

- K-2 teachers have not had many opportunities to learn about how young children learn mathematics or delve deeply into the content they are teaching.
- Professional development on early math learning and on visual models helps to inform instruction and the use of curricular materials.
- Take-up of the OGAP formative assessment tools and routines varies and is influenced by teachers' beliefs about students, their view of learning, and school-level contextual factors.
- Visual models play a key role in bridging students understanding of number as a collection of ones to an understanding of "ten-ness," multi-unit concepts, and the development of more sophisticated addition and subtraction strategies.

## Next Steps

- Revision of Number Progression
- Analysis of teacher interviews and teacher learning data (TASK)
- Case studies of implementation