

OGAP Multiplicative Professional Development Overview

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About the Ongoing Assessment Project (OGAP)

The Ongoing Assessment Project (OGAP) is a systematic and intentional formative assessment system in mathematics based on mathematics education research on how students learn specific concepts, common errors students make, and preconceptions or misconceptions that may interfere with learning new concepts or solving related problems.

The system involves using OGAP knowledge and the OGAP Frameworks/learning progressions to:

- 1) Gather evidence about pre-existing knowledge through the use of a pre-assessment;
- 2) Analyze the pre-assessment to guide unit planning; and
- 3) Implement a continuous and intentional system of instruction, probing with instructionally embedded questions, and analysis of evidence in student work to make timely instructional modifications.

Implementing the OGAP formative assessment system requires a commitment by teachers, teacher leaders, and administrators:

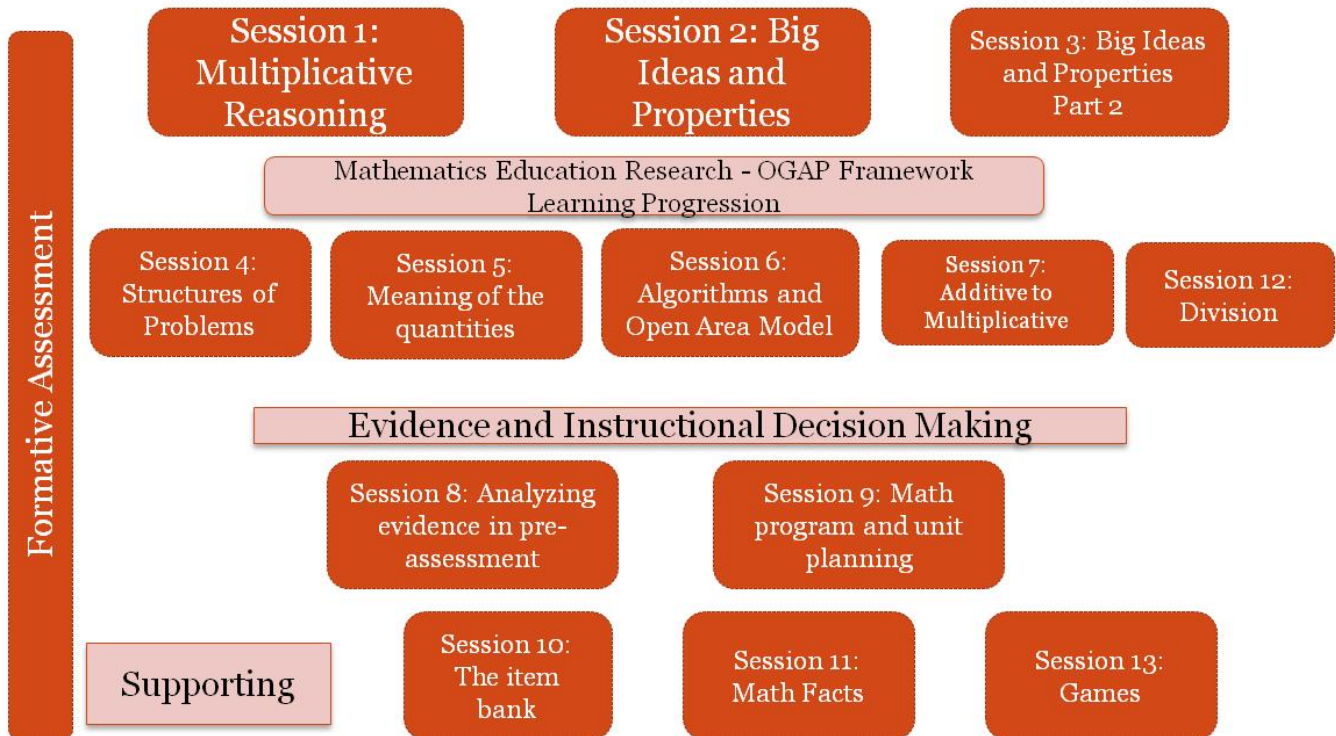
- a) to deepen professional development on related content, related math education research, and OGAP tools and strategies for gathering evidence from student work and making instructional decisions.
- b) to support and implement the ongoing nature of OGAP. For OGAP to have sustaining power districts/schools should provide teachers and teacher leaders time (e.g., regular PLC) to meet regularly to discuss evidence in student work, instructional implications, and implementation issues as they arise.
- c) to implement OGAP school wide. For example, it is strongly recommended that *all* teachers who teach mathematics (classroom teachers, special educators and interventionists), within grades 3-6 receive the professional development and ongoing support for fractions.

Evidence from OGAP work with hundreds of OGAP teachers has shown that utilizing the knowledge from the professional development is *only* solidified as teachers use this knowledge with students and that seems to happen best when teachers are supported on an ongoing basis through a system like PLCs.

IMPORTANT: If asked to do OGAP professional development in a school or district, please secure a commitment to a system of ongoing support.

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OGAP Multiplicative professional development consists of 14 sessions. These sessions are organized around multiplicative content, mathematics education research, evidence in student work and instructional decision-making. The sessions are shown below with descriptions of each session following on pages 8-13..



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OGAP Multiplicative Workshop Sessions
Session 1: What is Multiplicative Reasoning
Session 2: The Big Ideas and Properties of Multiplication Part 1
Session 3: The Big Ideas Part 2
Session 4: Problem Structures
Session 5: Meaning of the Quantities
Session 6: Algorithms and the Open Area Model
Session 7: Additive to Multiplicative
Session 8: Examining the Evidence in Student Work
Session 9: Math Program and Unit Planning
Session 10: The Item Bank
Session 11: Math Facts
Session 12: Division
Session 13: Games
Session 14: OGAP Multiplicative App
Other Important Documents: <ul style="list-style-type: none">• OGAP Multiplicative Framework/Learning Progression• Vermont OGAP Training Overview• Evidence Collection documents• CCSS• OGAP Item Bank• Pre-assessments

These sessions can be completed in about 4 days of professional development time implemented in a number of ways: 1) as a 4 day workshop or course; 2) as one 2-day and another 2-day workshop or course; 3) spread throughout in-service days or a course during the school year; and, 4) other variations that maintain the integrity of the materials and the ongoing use of OGAP materials and resources.

When you are thinking about the time you have for the workshops you should consider the following important features of OGAP Professional Development remembering that the professional development supports the implementation of the OGAP Formative Assessment system.

- 1) **Design of the sessions:** The OGAP multiplicative sessions intertwine math content, the mathematics education research about student learning of the concepts, analysis of evidence in student work with instructional implications, and review of instructional materials. Maintaining the integrity of these parts is critical. For example, looking at student work without understanding the research and content that underpins the work has been shown to be counterproductive. Think about each session as a package that moves participants through content, research and then implications for evidence in student work and instruction.

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- 2) **Thinking about order and implementation:** The sessions and the parts within sessions do not necessarily have to be implemented in the order of the session numbers. The facilitator notes and the information in this document makes suggestions of order in which the sessions should be implemented and ways in which the “parts” of the sessions can be completed during separate smaller workshop or during PLC time.
- 3) **Estimated times:** The facilitator notes provide times for each session. *These times are estimates.* The actual time to implement a session is dependent upon a number of factors: size of the group, the grades the teachers teach, math content knowledge, and knowledge of curriculum and instructional strategies. Use your judgment given the situation.
- 4) **Pre-assessments:** A key principle of OGAP is gathering evidence about student learning before instruction begins. To accomplish this, there are pre-assessments that participants should administer to their students prior to the OGAP training. The evidence from the pre-assessment will be analyzed as the workshop progresses. These can be analyzed during the workshop or at a PLC after the training. In either case, participants will have gathered initial information about their students learning during the professional development sessions.
- 5) **Analyzing evidence in student work:** The whole point of OGAP is to strengthen teachers’ ability to analyze evidence in student work to help make effective instructional decisions. To that point almost every session involves analyzing sets of student work and/or work from participant classrooms. While you can use the sets of student work in the workshop materials, the materials have greater relevance if the work comes from the participants’ classrooms. Importantly, as teachers analyze student work we ask participants to be constantly thinking about three questions.
 - a. What do you know from the evidence in student work that can be built upon?
 - b. What issues or concerns are evidenced in student work?
 - c. What are instructional implications of the evidence in student work?
- 6) **OGAP and the CCSSM:** All OGAP materials and professional development are aligned with the CCSSM. In particular, the CCSS is highlighted in a number of sessions.
- 7) **OGAP Professional Development Instructional Strategies:** These professional development materials utilize a range of instructional strategies designed to engage all participants *in thinking about* the important aspects of the workshops. Strategies such as:
 - a. **Think, Pair, Share:** “The Think-Pair-Share strategy is designed to differentiate instruction by providing students time and structure for thinking on a given topic, enabling them to formulate individual ideas and share these ideas with a peer. This learning strategy promotes classroom participation by encouraging a high degree of pupil response, rather than using a basic recitation method in which a teacher poses a question and one student offers a response. Additionally, this strategy provides an opportunity for all students to share their thinking with at least one other student which, in turn, increases their sense of involvement in classroom learning. Think-Pair-Share can also be used as an information assessment tool; as students discuss their ideas, the teacher can circulate and listen to the conversations taking place and respond accordingly.” <http://www.readwritethink.org/professional-development/strategy-guides/using-think-pair-share-30626.html> The think, pair, share strategy is used throughout OGAP training.

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- b. **Group work:** We suggest that participants be in groups of not more than 3 or 4 people for the most effective use of group work.
- c. **Questioning:** Questioning is used throughout all OGAP sessions as a strategy to deepen understanding of targeted concepts and ideas. In some cases probing questions are provided. However, facilitators should not limit themselves to those questions provided if opportunities arise.
- d. **Sharing Solutions:** The point of sharing solutions is to help deepen understanding of a concept. The point is NOT to give participants an opportunity to participate. For this strategy to be effective the facilitator must carefully select solutions to share with the mathematical goal in mind. See Session 1 Facilitator Notes, page 4 of the for an example.
- e. **Poster Sessions:** The point of poster sessions is to get *all* participants to think deeply about an idea or concept. We have found that the depth of discussion and thought increases when participants have to commit their ideas to a public poster. In addition, poster sessions are designed to synthesize ideas and concepts. See Session 3 Facilitator Notes, page 9 for one example of how to debrief a poster session.
- f. **Problem Solving:** Many sessions start with a set of problems or a single problem for the sole purpose of engaging participants in the mathematical ideas related to the session. Examples include: Sessions 1, 4, 6, 9, 10, 11, 12, 13, and 14. Providing participants ample time to engage in the problems, activity, or sets of problems in these sessions is critical.
- g. **Formative assessment:** Every session is designed to help the facilitator gather evidence about participant learning to guide their facilitation: a) listening and observing during individual work; b) listening and observing group discussions; c) analysis of posters as they are developed and discussed; d) Full group discussion; and, e) embedding problems into instruction as needed as entry or exit cards.
- h. **Using daily workshop evaluations:** Appendix B contains a sample of a daily evaluation. The point of the evaluation is for you to understand what is working and what needs modification as the workshop progresses along with eliciting any questions that participants have that need clarification. We have instituted a daily protocol of opening the following day's session by reviewing the evaluation information, addressing questions and concerns, and explaining any adjustments that have been made to the workshop as a result of the feedback. We suggest that you make a three slide power point: What's working; Issues/Concerns; Questions.

It is important to be explicit as the workshop progresses about the different instructional strategies you are using; what they are and why they are important. Most importantly, be clear that these same strategies can be used when participants are working with their own students.

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Some suggested readings about instructional strategies:

Chapin, S. H., O'Connor, C., & Anderson, N. C. (2009). *Classroom discussions: Using math talk to help students learn*. Sausalito, CA: Math Solutions.

Lamberg, T. (2013). *Whole Class Discussions: Improving In-depth Mathematical Thinking and Learning*. Pearson Publishing.

Smith M., & Stein, M.K. (2011) *5 Practices for Orchestrating Productive Mathematics Discussions*. National Council of the Teachers of Mathematics, Reston, VA.

Walsh, J., & Sattes, B. (2005). *Quality Questioning: Research-based practice to engage every learner*. Corwin Press, London, England.

Wiliam, D. (2011). *Embedded Formative Assessment*. Solution Tree Press, Bloomington, IN.

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Session 1: What is multiplicative reasoning? (1 hour and 40 minutes)

In this session participants will determine characteristics of multiplicative reasoning and begin to interact with the OGAP framework by examining some student work. They will also watch 2 video clips to help understand how teachers can facilitate movement from additive to multiplicative reasoning. Finally participants will begin to examine the OGAP Multiplicative Framework and use it to examine a set of student work.

Session 1A (10 minutes): Participants will examine a picture with potential for generating multiplicative thinking and generate questions related to multiplication they could use with students, using the picture.

Session 1B (20 minutes): Participants read a quote on multiplicative reasoning and then work in small groups to brainstorm a list of attributes the student with multiplicative reasoning demonstrates. This will be used to create a whole group list that will be posted and referred to throughout the training.

Session 1C (40 minutes): Participants will watch and discuss video clips that demonstrate strong instructional strategies and focus on building multiplicative reasoning in a group of third graders.

Session 1D (30 minutes): Participants will examine student work using the OGAP framework (30 minutes)

Session 2: The Big Ideas and Properties of Multiplication (1.5 hours)

In this session participants will break into groups of 3-4 people. They will answer one of six questions related to some of the big ideas related to multiplicative reasoning by reading provided information, discussing based on their experience and the information, and then create a poster to help other participants understand. They will then do a gallery walk to answer the questions they did not answer. At the end of the session the presenter will debrief the posters, highlighting and adding important information. The presenter will also do a short presentation on subitizing. This poster session is meant to clarify some of the properties of multiplication as well as other important concepts both teachers and students must understand.

Session 2A (30 minutes): In this part of the session participants will work in groups of 3-4 to respond to an assigned prompt from handout 2A. They will use handout 2B as one resource in answering their prompt. The work on their poster must stand alone in its explanation, for others to understand.

Session 2B (45 minutes): Participants will review and discuss the posters prepared by other groups. They will do a gallery walk with one other person, collecting and discussing information from each poster, for the purpose of clarifying and deepening their understanding. The facilitator will collect

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information from participants about which ideas they are least and most confident about, and lead a discussion to help solidify understanding. Many of these ideas will be reinforced throughout the training.

Session 3: Big Ideas and Properties, Part 2 (45 minutes)

This activity is a follow-up to Sessions 2 and participants' first opportunity to examine the CCSS. They will look specifically for what the CCSS expects related to multiplicative properties. Participants will discuss CCSS standard 3.OA.5 and then, in small groups, examine the CCSS at one grade level just related to properties and use of properties. They will also consider one question from SBAC and how it demonstrates one CCSS standard related to multiplicative properties.

Session 4: Problem Structures (2 hours)

In this activity participants first solve and then analyze nine problems for features/structures of the problems. The participants then sort the problems into three categories: easiest; moderate; most challenging. As they sort the problems participants record features that influenced their decisions. The debriefing of the activity will NOT focus on agreeing about where the problems are sorted, BUT the features that influenced the decision.

This session is focused on having participants become familiar with the research on structures of problems that influence students solving problems involving multiplication and division. Research indicates that students move back and forth between using multiplicative, transitional, and additive reasoning depending on the structure of the problems, the context in which the problems are situated and the strength of their multiplicative reasoning. (Cramer, Post, & Currier, 1993, Karplus, Pulos & Stage, 1983, VMP OGAP Pilots, 2006 & 2007)

Ultimately, a multiplicative reasoner should not be influenced by context, problem types, the quantities in the problems and their associated units, or numerical complexity. (Cramer., Post, Currier, 1993; Silver, Ed VT cite visit (2006)

Session 4A(30 minutes): Participants will solve nine problems requiring multiplicative reasoning independently and then will work in small groups to sort them and discuss the features that they used to sort.

Session 4B (60 minutes): Participants will engage in an interactive session to become familiar with what the research says about the structures of multiplicative problems. This part of session 4 should verify and expand on the first part of the session.

Session 4C (30 minutes): Participants will become familiar with a strategy for interpreting and solving word problems that can be used with students in the classroom.

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Session 5: Meaning of the Quantities (1 hour)

In this session participants will examine 4 pieces of student work for evidence of the students' understanding of the meaning of the quantities in the problems. The student work are examples of the types of errors that students make when they are not thinking about the quantities in the problem or in the solution. Participants are asked to address two areas when analyzing student responses 1 – 4.

- 1) What is the evidence that the student may not be interpreting the meaning of the quantities in the problem?
- 2) Suggest some questions you might ask each student or activities you might do to help them understand the meaning of the quantities in the problem and the solution.

They will generate a list of questions they might ask the student in order to help their understanding and share these as a whole group. Then we will examine the question types for similarities and differences.

Session 5A (30 minutes): Participants will work in small groups to examine 4 pieces of student work and create a set of questions meant to help understanding of both the teacher and student. These will be shared on posters with all participants and used for the part B discussion.

Session 5B (30 minutes): The facilitator will lead a discussion about the questions generated by the small groups. All participants will work with a partner to look for similar question types and trends in questions.

Session 6: Algorithms and the Open Area Model (45 minutes)

In this session participants will work in small groups to solve a multi-digit multiplication problem using the open area model, partial products and the traditional algorithm. They will be asked to show how each of them is related to each other. They will also be asked to explain how this is related to multiplying algebraic expressions. This poster session concludes with a whole group discussion meant to clarify the connections from algorithms to models. This is a session that can be replicated in a classroom with students. During this session there is another opportunity to look more closely at the CCSS-M.

Session 7: Additive to Multiplicative (2 hours)

In this session participants will examine student work to determine the strategy a student used and what might the next instructional step for the student. Participants will also learn that there are OGAP concept questions and application/context questions and they are examined and sorted for different information. They will sort 2 sets of student work (one of each type) and make some observations about the sets of work. Finally they will learn about subitizing (quick images), how it grows and develops

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over the grade levels, and its value as a strategy for getting students to develop multiplicative understanding.

Session 7A (60 minutes): In this part of session 7 participants will be looking at individual pieces of student work and locating it on the framework. The purpose of this it to have them more intentionally interact with the strategies represented on the OGAP framework and discuss what the next best instructional strategies might be.

Session 7B(60 minutes): In this part of the session participants will learn about the 2 types of OGAP items: Concept and Application. They will sort two sets of student work that provided for them, one of each type. Then they will sort some of their own student work from the training items.

Session 7C (20 minutes): The facilitator will lead an activity to deepen participants understanding of subitizing and how to use quick images to enhance students' understanding of multiplicative concepts.

Session 8: Analyzing Evidence in Student Work (1 hour)

This session is an opportunity to analyze any student work from participants' training items (pre-assessment) that have not been analyzed yet. Then they will use two forms to tell the story of their students in terms of their understanding of multiplicative reasoning in terms of both concept and application understanding. This session is often done at 2 different times.

Session 8A(20 minutes): Participants will solve the items in the pre-assessment and discuss what challenges their students might have when solving the problems. This part of session 8 should be done before teachers give the pre-assessment to their students.

Session 8B(40 minutes): Participants will review all the evidence they have collected throughout the training and use the information to tell the story of their classroom.

Session 9: Math Program and Unit Planning (1.5 hours)

In this activity participants will draw on the evidence they have collected from analyzing student pre-assessments or training items (Session 8) and knowledge they have on the cognitive research to review their math program materials. They will look for gaps and address these as well as selecting appropriate OGAP items that can be used to quickly check for understanding at the end of lessons and inform their instruction for the following lessons.

NOTE: This session must follow the session on Navigating the Item Bank(Session 10) and Telling the Story (Session 8).

Session 9A(45 minutes): Examining their math program for gaps.

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Session 9B(45 minutes): Planning for instruction, considering the gaps teachers have identified in their math program.

Session 10: Navigating the Item Bank (1.5 hours)

In this session participants will become familiar with how the item bank is organized, how to locate items, what their structures are, and what the research says about problem situations. Participants will examine what the CCSS-M expects for problem contexts and the alignment with the OGAP item bank. They will also connect the framework to the item bank by looking closely at the last are of the framework they haven't examined. Participants will form small groups and examine one section of the item bank to help fellow participants understand it more thoroughly.

Session 11: Math Facts (40 minutes)

In this session participants will work together to develop a list “thinking” strategies for developing fact fluency. They will also participate in a discussion about strategies for helping students gain automaticity with math facts. They will become familiar with the research on math facts acquisition. This session is best taught right before session 13 on Analyzing Math Games.

Session 12: Division (1 hour 45 minutes)

This session is designed to help teachers learn how to bring meaning to the division and builds an understanding about how the model can be used to make sense of the relationship between multiplication and division and the magnitude of the results. Researchers strongly suggest that students should experience a range of division situations and build fluency with understanding through modeling and use of estimation (Kieren, as cited in Huinker, 2002; Aksu, 1997). To this end the session involves participants in modeling division problems as well as activities that develop understanding of the different meanings of division (partitive and quotative) and remainders. Next participants analyze evidence in student work using the OGAP Framework and engage in discussions about instructional next steps based on the evidence.

Session 12A(20 minutes): Participants will form small groups to write and solve 2 division word problems based on one equation.

Session 12B (30 minutes): The facilitator will lead a discussion to debrief the word problems and solutions. This is a poster session where the focus will be on a whole group discussion after pairs examine trends in the work and share observations.

Session 12C (30 minutes): The facilitator leads this part of the session focused on algorithms for large number division and building student understanding.

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Session 12D(25 minutes): Participants will sort a common set of student work and then examine their own student work. They will add their findings to the Telling the Story documents they worked on in session 8.

Session 13: Analyzing Math Games (1 hour)

In this session participants will play a variety of multiplication games in order to analyze the intent and plan for explicit and intentional instruction related to the games. Games are one strategy for increasing automaticity with math facts and for developing understanding of multiplicative concepts.

This session can be done in one block of time or the games can be used as warm-ups or filler for a short block of time that can't be used for anything else or as a change of pace in a training day. In the hour session not everyone will be able to play each game but they can do enough to get the idea of the effective use of each of the math games.

Session 14: OGAP Multiplicative App (45 minutes)

In this session participants will learn how to use the OGAP app. They will become familiar with how to sign in and navigate the tools/tasks in the app. This includes creating assignments/selecting tasks and recording student work. This session should be done after session 12 and before session 8.

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Appendix A: Daily Evaluation

Date _____

Classroom teacher school or district mathematics teacher leader
 Other _____

1) What activities and/or concepts in today's workshop were especially useful for you?

2) Do you have any issues or concerns about the workshop? If yes, describe.

3) What questions do you have for the instructors?